



Emerson Network Power

CASE STUDY

DRIVING PLANET-SAVING
INNOVATION



DIGITAL REALTY



Emerson and Digital Realty worked together to explore energy savings and operational performance.

Knowing that Digital Realty is both cost conscious and a willing innovator, Emerson Network Power, a business of Emerson and the world's leading provider of critical infrastructure for information and communications technology systems, proposed moving from a water-cooled thermal management system to one that uses pumped refrigerant—an alternative technology that promised both capex and opex savings as well as operational improvements.

California's economization requirements

California's Energy Commission (CEC) leads the nation in environmental energy standards governing public buildings, with special attention to those like data centers, where it requires that computer rooms use economization in their heat rejection processes when outside air temperatures fall to certain levels.



To quote engineer Ty Colwell in a recent Data Center Journal article, “Cooling economization is a set of cooling techniques whereby the cooling medium (either air or water) rejects heat directly to the outside environment, eliminating the use of motor-driven compressors and the traditional refrigeration cycle”¹.

Shutting down the cooling machinery at lower temperatures and moving to passive heat rejection for “free cooling” significantly reduces the power a data center consumes.

In 2012, when Emerson Network Power first proposed the Liebert® DSE™ system, their pumped refrigerant economization solution, to Digital Realty, only air and water coolants were approved for data center economization in California. CEC Title 24 required that air-side-economized systems be capable of carrying 100% of the IT heat load when the outside air temperature is 55°F or lower. Water-side economization systems were required to carry 100% of the IT heat load at temperatures of 40°F or lower.

Partnering to prove the worth of pumped refrigerants

Emerson developed their Liebert DSE system for use in small to medium sized data centers where chilled water thermal management was either too expensive or simply too big for the space available. Digital Realty was open to exploring a new cooling solution.

For nine months, Emerson and Digital Realty worked together to explore the energy savings and operational performance benefits of a pumped refrigerant system and compared it to that of a chilled water system. If the results proved to be promising, the companies intended to share them with the CEC and apply for a formal exception to the air- and water- only rule in order to bring a promising new cooling solution to market. Digital Realty is utilizing the Liebert DSE system to save more than 350 million gallons of water annually in its data centers, compared to using chilled water systems. It has deployed the technology in data centers in California, Virginia, Texas and Australia and is considering it for use in Europe.

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¹Data Center Journal, December 2015 (<http://www.datacenterjournal.com/california-title-24-requirements-data-center/>)

	MWh	%MWh	TDV kBtuh/ft ²	%TDV	Water Reduction (1000gal/year)
Climate Zone	Reduction				
Climate Zone 1- Arcata	-686.8	30%	-803.8	28.1	3,875
Climate Zone 2- Santa Rosa	-338.1	14.8%	-285.9	9.9	4,260
Climate Zone 3- Oakland	-364.5	16.3%	-388.1	13.9	4,063
Climate Zone 4- Sunnyvale	-336.5	14.4%	-294.0	10.1	4,378
Climate Zone 5- Santa Maria	-426.1	18.4%	-457.0	15.9	4,003
Climate Zone 6- Los Angeles	-236.9	10.3%	-234.0	8.3	4,258
Climate Zone 7- San Diego	-225.1	9.8%	-235.0	8.1	4,280
Climate Zone 8- El Toro	-239.1	10.3%	-198.3	6.9	4,312
Climate Zone 9- Pasadena	-217.2	9.4%	-186.7	6.5	4,414
Climate Zone 10- Riverside	-101.9	4.5%	1.8	-0.1	3,664
Climate Zone 11- Red Bluff	-396.4	15.6%	-259.3	8.1	4,755
Climate Zone 12- Sacramento	-296.3	12.7%	-219.2	7.3	4,541
Climate Zone 13- Fresno	-190.9	8.1%	-60.4	2.0	4,822
Climate Zone 14- China Lake	-204.4	8.4%	-37.6	1.2	5,061
Climate Zone 15- El Centro	94.0	-4.0%	291.9	-9.9	5,551
Climate Zone 16- Mount Shasta	-632.1	25.9%	-610.1	19.8	4,154
Average	-299.9	12.8%	-248.5	8.5	4,399
Industry Weighted Average (per 1.2MW)	-293.0	12.1%	-278.0	10.2	4,274

Savings in 14 of 16 climate zones on 3 of 3 metrics

The results, as presented in the document Emerson presented to the CEC as part of their application for Compliance Exception, were more than promising—they were persuasive. The chart, which is part of that application, catalogs real numbers and percentages savings achieved in each of California’s 16 climate zones. The chart reports savings by megawatts, by Time Dependent Valuation, and by the reduction of water use, per zone².

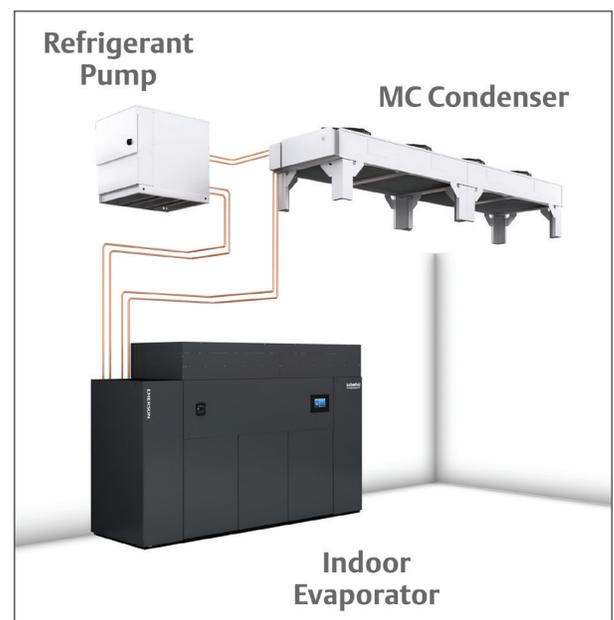
The Water Win

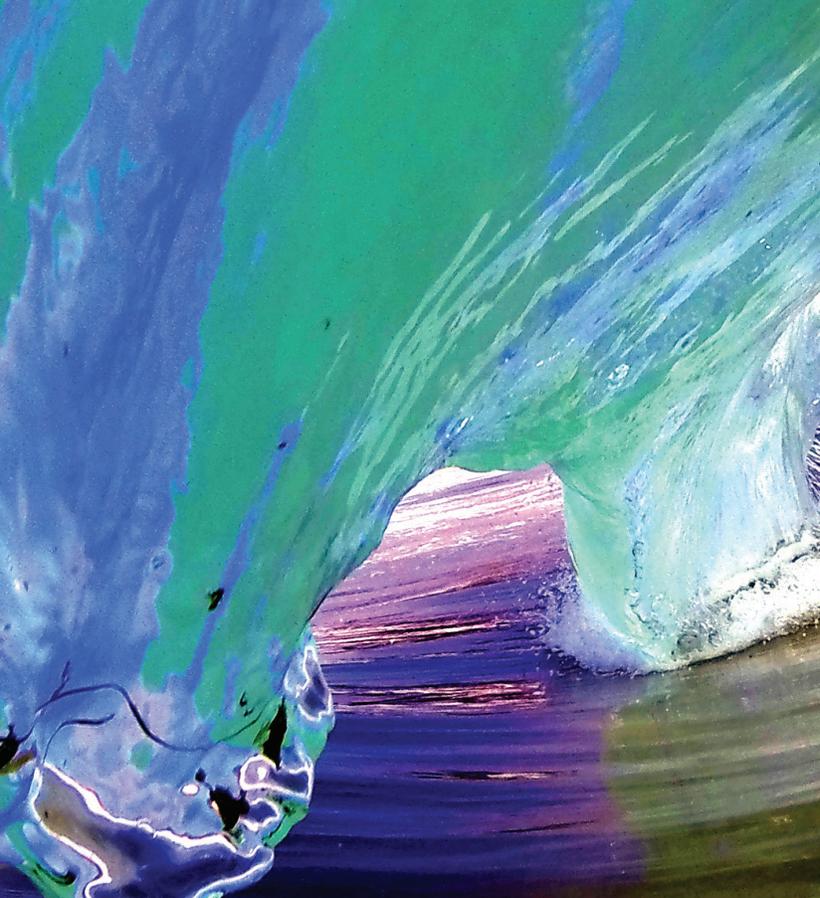
While the review by the CEC initially focused on ensuring adequate energy performance for this system, the analysis clearly indicated that there was another compelling value for this system – significant water use reductions. A cooling system with a water economizer uses an average of 4.3 million gallons of water per year for a data center with an IT load of 1.2 MW. If that same data center were to employ air-side economization, the water spend would still be 2.7 million gallons (with no lower dew point control) or 3.2 million gallons (with

lower dew point control) of water per year during the chiller operation. Emerson’s Liebert DSE system eliminates water usage for cooling altogether.

Making Installation Easy

The Liebert DSE with pumped refrigerant economizer system comprises several components—a pumped





refrigerant economizer, a micro-channel condenser, and an indoor CRAC unit.

This operates like a standard air cooled direct expansion (DX) system, but when criteria for economization are met, the compressors turn off and the refrigerant pump turns on to move the refrigerant through the system to reject the heat of the data center, using only a fraction of the power of a compressor.

The Emerson-Digital Realty partnership also had to find a simple and cost effective way to site and install the necessary equipment. Emerson adapted a solution they had developed for electrical products, factory-mounting the system components on skids, so only the skids themselves required installation on the data center roof, thus satisfying Digital Realty's strong preference for minimal on-site construction.

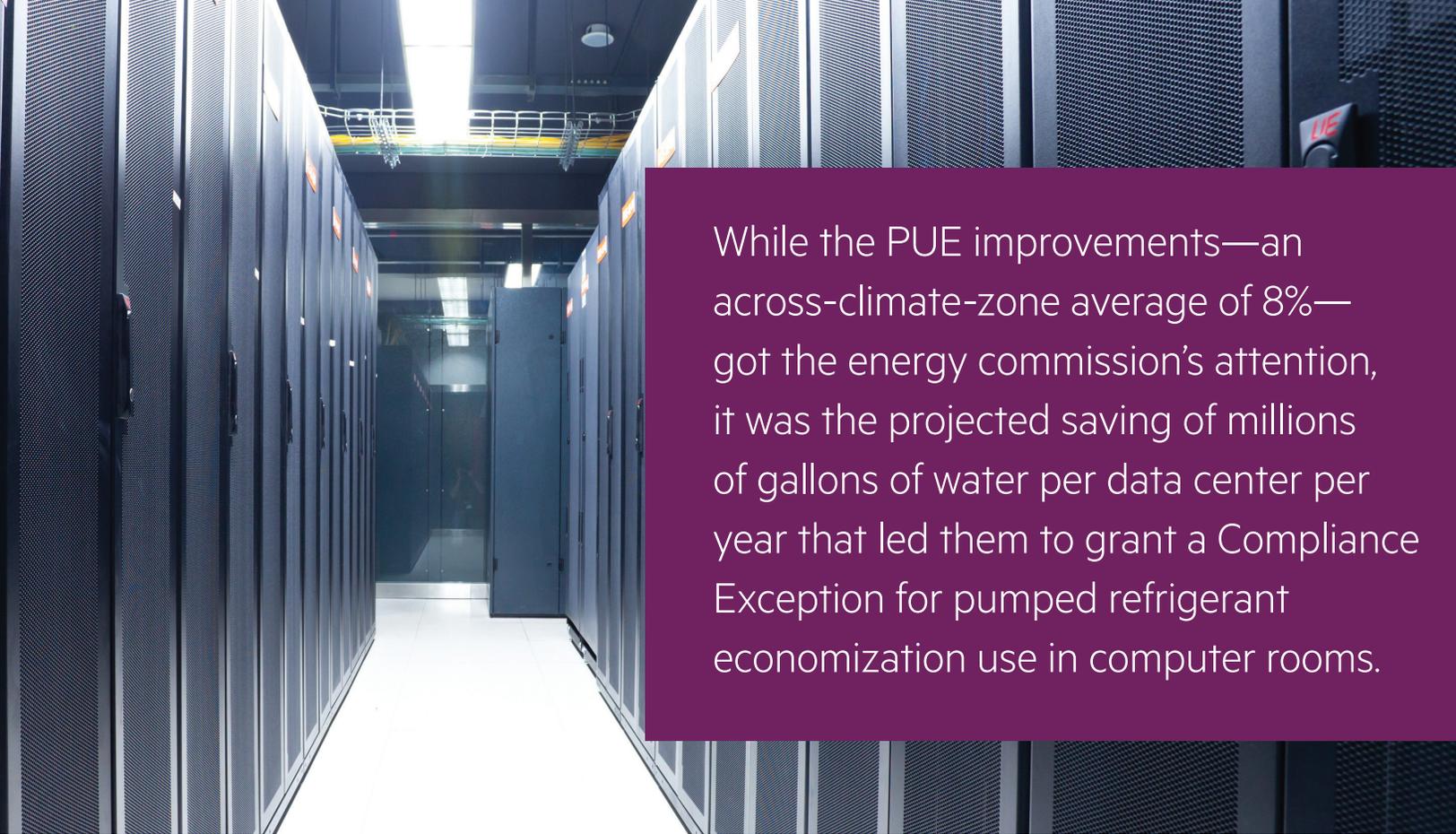
The solution has now been deployed at Digital Realty data centers in California, Virginia, Texas, and Australia, with Europe exploring the advantages of the solution.

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Working together, we won acceptance for an environmentally significant thermal management solution that delivered energy efficient and water-saving performance. That same solution makes great business sense.

- John Peter Valiulis, Vice President of Marketing at Liebert Thermal Management, an Emerson Network Power business.

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While the PUE improvements—an across-climate-zone average of 8%—got the energy commission’s attention, it was the projected saving of millions of gallons of water per data center per year that led them to grant a Compliance Exception for pumped refrigerant economization use in computer rooms.

About Digital Realty

Digital Realty Trust, Inc. supports the data center and colocation strategies of more than 1,000 firms across its secure, network-rich portfolio of data centers located throughout North America, Europe, Asia and Australia. Digital Realty’s clients include domestic and international companies of all sizes, ranging from financial services, cloud and information technology services, to manufacturing, energy, gaming, life sciences and consumer products.

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